

REMARKS

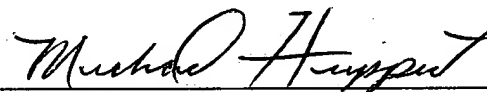
The present Preliminary Amendment is submitted to delete the multiple dependency of claims 3, 5-6, 8 and 11, thereby placing such claims in condition for examination and reducing the required PTO filing fee.

Copies of the amended portion of the claims with changes marked therein is attached and entitled "*Version with Markings to Show Changes Made.*"

Respectfully submitted,

Akihisa HONGO et al.

By



Michael S. Huppert
Registration No. 40,268
Attorney for Applicants

MSH/kjf
Washington, D.C.
Telephone (202) 721-8200
Facsimile (202) 721-8250
February 9, 2001

CLAIMS

09/762582

JC05 Rec'd PCT/PTO 0 9 FEB 2001

1. A method of plating a substrate to fill a wiring recess formed in a semiconductor substrate with plating metal, said method comprising:

performing an electroless plating process of forming an initial layer on a substrate; and

performing an electrolytic plating process of
filling said wiring recess with plating metal while said
10 initial layer serves as a feeding layer.

2. An apparatus for plating a substrate to fill a wiring recess in a semiconductor substrate with plating metal, said apparatus comprising:

15 an electroless plating tank for forming an
initial layer on a substrate by electroless plating;

an electrolytic plating tank for filling said wiring recess with plating metal while said initial layer serves as a feeding layer; and

20 transfer means for transferring a substrate
between said tanks.

3. A method ~~[or apparatus]~~ for plating a substrate according to claim 1 ~~or 2~~, comprising in said electroless
25 plating process or said electroless plating bath:

means for disposing a substrate to be plated in such a state that a surface to be processed thereof faces upwardly, and forming a hermetically sealed space by said

surface to be processed; and

plating liquid supply means for supplying an electroless plating liquid to said hermetically sealed space to perform an electroless plating process.

5

4. A method ~~[or apparatus]~~ for plating a substrate according to claim 3, wherein the minimum amount of electroless plating liquid required for performing a predetermined plating on said substrate to be plated is
10 supplied to said hermetically sealed space, and the electroless plating process is performed with said electroless plating liquid in a static state.

5. A method ~~[or apparatus]~~ for plating a substrate
15 according to claim 3 ~~or 4~~, further comprising:

pressure pulsation means for generating a pressure in said hermetically sealed space that is higher than atmospheric pressure and for pulsating said pressure.

20 6. A method or apparatus for plating a substrate according to ~~any one of claims~~ ^{claim} 3 ~~through 5~~, further comprising a preparation bath disposed in the vicinity of said hermetically sealed space for supplying said minimum amount of prepared electroless plating liquid to said
25 hermetically sealed space just prior to the electroless plating process.

7. A method ~~[or apparatus]~~ for plating a substrate.

according to claim 6, wherein said electroless plating liquid is processed as a waste liquid without circulating said electroless plating liquid after performing the electroless plating process with said minimum amount of
5 electroless plating liquid.

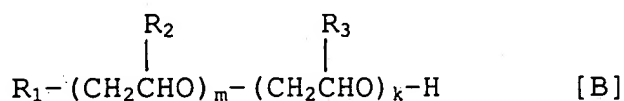
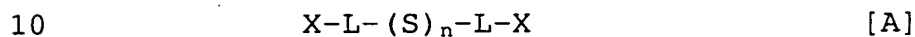
8. A method ~~[or apparatus]~~ for plating a substrate according to claim 1 ~~or 2~~, wherein said plating liquid used ⁱⁿ said electroless plating process or said electroless plating
10 bath comprises copper sulfate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) having a concentration of 100 to 250 g/l, sulfuric acid (H_2SO_4) having a concentration of 10 to 100 g/l, and chlorine ions having a concentration of 0 to 100 mg/l.

15 9. A method ~~[or apparatus]~~ for plating a substrate according to claim 8, wherein said electrolytic plating liquid further comprises at least 0.14 to 70 $\mu\text{mol/l}$ of a sulfur compound expressed by a formula in [A] below, 10 to 5000 mg/l of a macromolecular compound expressed in a
20 formula [B] below, and 0.01 to 100 mg/l of a nitrogen compound;

wherein L is an alkyl group having a carbon number of 1 to 6 which is substituted by a lower alkyl group, a lower alkoxyl group, a hydroxyl group, or a halogen
25 atom; and X is a hydrogen atom, a $-\text{SO}_3\text{M}$ group, or a $-\text{PO}_3\text{M}$ group (M indicating a hydrogen atom, an alkali metal atom, or an amino group) in the formula [A]; and

R1 indicates a residue of a higher alcohol group

having a carbon number of 8 to 25, a residue of an alkyl phenol with an alkyl group having a carbon number of 1 to 25, a residue of an alkyl naphthol with an alkyl group having a carbon number of 1 to 25, a residue of a fatty acid amide having a carbon number of 3 to 22, a residue of an alkylamine having a carbon number of 2 to 4, or a hydroxyl group; R2 and R3 indicate a hydrogen atom or a methyl group; and m and k indicate an integer from 1 to 100 in the formula [B].



10. An apparatus for plating a substrate to fill a wiring recess formed in a semiconductor substrate with plating metal, said apparatus comprising:

one processing tank having an electroless plating liquid supply path for supplying an electroless plating liquid to form an initial layer on a substrate by electroless plating process, and an electrolytic plating liquid supply path for supplying an electrolytic plating liquid to fill said wiring recess by electrolytic plating while said initial layer serves as a feeding layer;

wherein the two paths are selectively switchable.

25

11. A method ~~for apparatus~~ ^{claim} for plating a substrate according to ~~any one of claims 1 through 10~~ ¹, wherein said plating liquid used in said method ~~for apparatus~~ does not

include an alkali metal as a pH regulator.

5

00763333.041304

)